

PCT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C.20231
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 06 July 2000 (06.07.00)	
International application No. PCT/NZ99/00193	Applicant's or agent's file reference P410245 KRM
International filing date (day/month/year) 17 November 1999 (17.11.99)	Priority date (day/month/year) 17 November 1998 (17.11.98)
Applicant DARBY, Adam, John et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 30 May 2000 (30.05.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Nestor Santesso Telephone No.: (41-22) 338.83.38
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ 99/00193

A. CLASSIFICATION OF SUBJECT MATTER		
Int Cl ⁷ : D06F 33/02		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) D06F 33/		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT : D06F 33/- and pump + and (stop+ or repeat+ or or intermit+)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent abstract Accession No 86-234682/36 class F07 JP 61162980 A (MATSUSHITA ELEC IND KK) 23 July 1986 Abstract	1-6
X	Derwent abstract Accession No 93-139666/17 class F07 JP 05076687 A (HITACHI LTD) 30 March 1993 Abstract	1-6
X	Derwent abstract Accession No 98-265302/24 class F07 JP 10085487 A (SANYO ELECTRIC CO LTD) 7 April 1998 Abstract	1-6
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
<p>* Special categories of cited documents:</p> <p>"A" Document defining the general state of the art which is not considered to be of particular relevance earlier application or patent but published on or after the international filing date</p> <p>"E" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"L" document referring to an oral disclosure, use, exhibition or other means</p> <p>"O" document published prior to the international filing date but later than the priority date claimed</p> <p>"P" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"T" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"X" document member of the same patent family</p> <p>"Y"</p> <p>"&"</p>		
Date of the actual completion of the international search 10 March 2000		Date of mailing of the international search report 20 MAR 2000
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No.: (02) 6285 3929		Authorized officer PETER WARD Telephone No.: (02) 6283 2129

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ 99/00193

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 407272 A (ESSWEIN S.A.) 9 January 1991 Abstract	1-6

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/NZ 99/00193

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-6, a method of operating a drain pump in a washing machine.
2. Claims 7-10, a method of braking a washing machine spin tub.
3. Claim 10 directed to a method of powering on and off a washing machine.
4. Claim 11 directed to an optocoupler drive circuit.
5. Claims 12-14 directed to a laundry machine drain pump drive.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-6

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

Information on patent family members

PCT/NZ 99/00193

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
EP	407272	FR	2649422

END OF ANNEX

PATENT COOPERATION TREATY
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P410245 KRM	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. PCT/NZ99/00193	International Filing Date (<i>day/month/year</i>) 17 November 1999	Priority Date (<i>day/month/year</i>) 17 November 1998
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ D06F 33/02		
Applicant FISHER & PAYKEL LIMITED et al		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2.	This REPORT consists of a total of 5 sheets, including this cover sheet. <input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT). These annexes consist of a total of 3 sheet(s).
3.	This report contains indications relating to the following items: I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input checked="" type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 30 May 2000	Date of completion of the report 6 February 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer D.R. LUM Telephone No. (02) 6283 2544

I. Basis of the report

1. With regard to the elements of the international application:*
- ☐ the international application as originally filed.
- ☒ the description, pages 1-11, as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 12-14, received on 8 November 2000 with the letter of 8 November 2000
- ☒ the drawings, pages 1/5-5/5, as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of
2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:
- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).
3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, was on the basis of the sequence listing:
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
4. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.
5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be nonobvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☐ claims Nos. 7-14

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for said claim Nos. 7-14

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

The international preliminary examination report has been drawn up in respect of the entire international application but the International Preliminary Examining Authority is of the opinion that the application does not appear to comply with the requirements of unity of invention as set forth in the PCT regulations (Article 34(3), Rule 68(1) PCT).

The separate groups of invention are:

1. Claims 1-6 are directed to a method of operating a drain pump in a washing machine.
2. Claims 7-9 are directed to a method of braking a washing machine spin tub.
3. Claim 10 is directed to a method of powering
4. Claim 11 is directed to an optocoupler drive circuit.
5. Claims 12-14 are directed to a laundry washing machine.

Since the abovementioned groups of claims do not share any of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept, a priori.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.
- ☒ the parts relating to claims Nos. 1-6

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-6	YES
	Claims	NO
Inventive step (IS)	Claims 1-6	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-6	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

Claims 1-6 meet the criteria set forth in PCT Article 33(2)-(4) for novelty, inventive step and industrial applicability. The prior art published before the priority date does not disclose a method of operating a drain pump in a laundry washing machine which comprises the steps defined in (a) and (b) of claim 1 and then repeating the steps (a) and (b) for the duration of the drain phase.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 20 FEB 2001

WIPO

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Applicant's or agent's file reference P410245 KRM	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).	
International Application No. PCT/NZ99/00193	International Filing Date (day/month/year) 17 November 1999	Priority Date (day/month/year) 17 November 1998
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ D06F 33/02		
Applicant FISHER & PAYKEL LIMITED et al		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheet(s).

3. This report contains indications relating to the following items:

- | | | |
|------|-------------------------------------|---|
| I | <input checked="" type="checkbox"/> | Basis of the report |
| II | <input type="checkbox"/> | Priority |
| III | <input checked="" type="checkbox"/> | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| IV | <input checked="" type="checkbox"/> | Lack of unity of invention |
| V | <input checked="" type="checkbox"/> | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| VI | <input type="checkbox"/> | Certain documents cited |
| VII | <input type="checkbox"/> | Certain defects in the international application |
| VIII | <input type="checkbox"/> | Certain observations on the international application |

Date of submission of the demand 30 May 2000	Date of completion of the report 6 February 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer D.R. LUM Telephone No. (02) 6283 2544

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- ☒ the description, pages 1-11, as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 12-14, received on 8 November 2000 with the letter of 8 November 2000
- ☒ the drawings, pages 1/5-5/5, as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of
2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:
- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
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- ☐ furnished subsequently to this Authority in written form.
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** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be nonobvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☐ claims Nos: 7-14

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☒ no international search report has been established for said claim Nos. 7-14

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

The international preliminary examination report has been drawn up in respect of the entire international application but the International Preliminary Examining Authority is of the opinion that the application does not appear to comply with the requirements of unity of invention as set forth in the PCT regulations (Article 34(3), Rule 68(1) PCT).

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2. Claims 7-9 are directed to a method of braking a washing machine spin tub.
3. Claim 10 is directed to a method of powering
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- ☐ all parts.
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V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-6	YES
	Claims	NO
Inventive step (IS)	Claims 1-6	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-6	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

Claims 1-6 meet the criteria set forth in PCT Article 33(2)-(4) for novelty, inventive step and industrial applicability. The prior art published before the priority date does not disclose a method of operating a drain pump in a laundry washing machine which comprises the steps defined in (a) and (b) of claim 1 and then repeating the steps (a) and (b) for the duration of the drain phase.



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : D06F 33/02	A1	(11) International Publication Number: WO 00/29660 (43) International Publication Date: 25 May 2000 (25.05.00)
(21) International Application Number: PCT/NZ99/00193 (22) International Filing Date: 17 November 1999 (17.11.99) (30) Priority Data: 332836 17 November 1998 (17.11.98) NZ (71) Applicant (for all designated States except US): FISHER & PAYKEL LIMITED [NZ/NZ]; 78 Springs Road, East Tamaki, Auckland (NZ). (72) Inventors; and (75) Inventors/Applicants (for US only): DARBY, Adam, John [NZ/NZ]; 2/24 Regia Close, Bucklands Beach, Auckland (NZ). MCGILL, Ian, Campbell [NZ/NZ]; 88 Kohimarama Road, Kohimarama, Auckland (NZ). NEVINSON, Lorraine [NZ/NZ]; 9 Alexander Avenue, Maraetai, Auckland (NZ). SMYTHE, Laurence, Evan [NZ/NZ]; 55 Corania Crescent, Lynfield, Auckland (NZ). TAYLOR, Samuel, John, Selwyn [NZ/NZ]; 9 Woodbine Avenue, Greenlane, Auckland (NZ). CHEYNE, Neil [NZ/NZ]; 8 Annagarz Rise, Howick, Auckland (NZ). HARWOOD, Jonathan, David [NZ/NZ]; 10B Halsey Road, Manurewa, Auckland (NZ).		(74) Agents: CALHOUN, Douglas, C. et al.; A J Park & Son, Huddart Parker Building, 6th floor, Post Office Square, P.O. Box 949, Wellington 6015 (NZ). (81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, RU, SE, SG, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: LAUNDRY MACHINE (57) Abstract <p>A laundry washing machine having a drain pump operating regime where the pump is turned off briefly at periodic intervals to minimise blocking. The pump may be powered by a variable frequency, variable duty cycle drive to minimise the effects of ventilation and varying main supply voltage. The spin tub is braked by dumping the electrical energy regenerated by the main motor into the inductive winding of an ancillary motor, such as a pump motor, or of a solenoid valve. A method of powering on and off a laundry washing machine and an optocoupler drive circuit are also disclosed.</p>		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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EE	Estonia	LR	Liberia	SG	Singapore		

LAUNDRY MACHINE

TECHNICAL FIELD

5 This invention relates to laundry machines. In particular it relates to laundry machine drain pump control, power supplies, electronically commutated permanent magnet motor drives and motor braking during spin dry cycles.

BACKGROUND ART

10 Most laundry machine drain pumps use an AC induction motor or synchronous motor, operating off the mains frequency, which is typically 50 or 60Hz. This fixed frequency, along with the mains voltage, determines the design of the pump, and hence the flow rate and maximum head height that can be obtained.

15 There are numerous disadvantages of a fixed mains-frequency pump motor. These are: (a) the starting torque is typically low, making the pump susceptible to being blocked, (b) separate pump designs are needed for countries having differing mains voltage and frequency, (c) the noise level during "ventilation" is high, particularly when running at a supply frequency of 60Hz, (d) the torque varies with the mains voltage and (e) there is no feedback to indicate if the pump is faulty.

20 By the nature of the washing process debris, including strands of textile, is removed from the wash load and flushed into the sump of the washing machine. This debris is then pumped out along with the dirty wash water. Occasionally the pump impeller will catch on the debris, or will start accumulating textile strands and then stop pumping.

25 Problems of this nature have been solved in other industries such as sewage handling, by having powerful motors driving pumps, with large clearances and large flow passages. Home appliances, however, do not have the space available to utilise large flow passages. One small volume solution in use is the vortex impeller, where the impeller has a shroud around it that eliminates the jamming point between vane end and the 'cutwater'. Unfortunately this pump has the disadvantage that it can still become
30 blocked by bundles of fibres that become twisted "ropes" in the centre of the vortex.

Traditionally a laundry washing machine is turned off by employing one of two methods. In the first power to the washer is isolated using an expensive mains rated switch which de-energises it and makes power consumption negligible. The switch
35 must be capable of carrying and breaking the total current required at the required voltage. In the second method the machine is made to appear it has been switched off

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by removing all power on indications on its control panel. In reality the machine's power usage is the same when it appears to be switched off as when it is switched on. These methods have the respective disadvantages that either a high current and/or voltage rated switch is required or power is consumed unnecessarily when the laundry machine is not in use.

The use of permanent magnet rotor three winding stator motors with electronic commutation of the windings is known. A common way of driving an electronically commutated three phase motor is to configure it in an H-Bridge between two dc rails, as shown in figure 5. The six power transistors Q1 to Q6 energise the motor windings by switching in a particular pattern. It is possible to have a high level of control over the speed and torque of the motor if feedback on the position of the rotor is available to the drive circuit logic which controls the switching pattern. The transistors are switched on by applying a voltage, usually 15V, from gate to source. Because the source voltage varies from 0V to the DC rail voltage, some technique is required to get the signal from the driving logic, which is referenced to 0V, to the high side gate which is referenced to the phase output (A, B, and C).

Common techniques are to use pulse transformers, purpose-designed ICs such as the IR2111, or optocouplers. A typical prior art circuit which employs an optocoupler for driving the high side transistor is shown in Figure 6. When transistor Q2 switches off, noise is generated which tends to pull the optocoupler off. A logic inverter q4 ensures that turn off to the optocoupler means turn off of Q1. Since Q1 should always be off during turn off of Q2, correct operation of the circuit is not compromised. The disadvantage of this conventional optocoupler drive design is that high quality and therefore high cost devices are required.

During laundry machine spin dry cycles the spin tub is rotated at relatively high speed. At the termination of the spin cycle it is desirable to brake the motor to minimise spin tub run down speed. Conventionally this has been achieved by connecting resistors across the motor windings. This technique has the disadvantage that relatively high power resistors are required and these add to the cost of the laundry machine.

DISCLOSURE OF THE INVENTION

It is therefore an object of the present invention to provide a laundry machine having drain pump control, a power supply, a motor drive, and a motor braking system which overcomes the respective disadvantages outlined above.

In a first aspect the invention consists in a method of operating a drain pump in a laundry washing machine during the drain phase of the wash cycle to reduce pump blockages characterised in that:

- (a) the pump is started and run for a first period of time,
- 5 (b) the pump is stopped for a second period of time which is less than 10% of said first period of time, and
- (c) steps (a) and (b) are repeated for the duration of said drain phase.

In a second aspect the invention consists in a method of braking a top loading laundry washing machine spin tub wherein said spin tub is driven by an electronically commutated DC motor, wherein the commutation devices are connected to a DC power supply and have free-wheeling diodes connected in parallel therewith, and wherein said washing machine includes other components having inductive windings,

characterised in that:

commutation of power to the motor windings is terminated,

15 the voltage of the DC power supply is monitored,

and when the DC power supply voltage exceeds a pre-determined value the inductive winding of an unused component in said machine is connected across said DC power supply until the DC power supply voltage reduces below said pre-determined value.

20 In a third aspect the invention consists in a method of powering on and off a laundry washing machine where power is consumed in the form of direct current using a switched mode power supply of the type described in Australian Patent 651408 characterised in that:

an active switching device connected between the base of the lower switch in the motor bridge drive used as part of said switched mode power supply and the lower voltage rail is switched on by a latching circuit to cause the DC power supplies in said machine to be disabled,

25 the latching circuit comprises a capacitor charged from the high voltage rail for said laundry machine motor in parallel with a transistor biased from the switched mode power supply low voltage rail, and

30 a push button normally off switch connected in parallel with said capacitor is used to discharge said capacitor to disable said latching circuit to thereby enable the laundry machine DC power supplies.

35 In a fourth aspect the invention consists in an optocoupler drive circuit for the high side of a totem pole power transistor pair in a bridge circuit for commutating a motor characterised in that the optocoupler does not use a logic inverter on the output side and

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the optocoupler transistor is controlled to limit the speed of turn off and thus the speed of turn on of the upper power transistor in the totem pole.

In a fifth aspect the invention consists in a laundry washing machine including a wash bowl drain pump characterised in that:

5 said pump is driven by a variable speed motor which in turn is driven by a variable frequency pulse width modulated inverter,

 and the pump motor frequency is decreased at low bowl water levels to reduce the effects of ventilation.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

 Figure 1 shows a plan view of a laundry machine sludge pump,

 Figure 2 shows alternative impellers for the sludge pump.

 Figure 3 shows a voltage waveform for a laundry machine sludge pump controlled in accordance with the present invention,

15 Figure 4 shows a circuit for a laundry machine power supply derived from the laundry machine motor drive,

 Figure 5 shows a totem pole switching circuit for a three phase motor drive,

 Figure 6 shows a high side drive circuit using an optocoupler for the circuit of Figure 5,

20 Figure 7 shows a high side optocoupler drive circuit according to the present invention, and

 Figure 8 shows a braking circuit for a laundry machine motor.

25 **BEST MODES FOR CARRYING OUT THE INVENTION**

25 **Pump stopping to clear lint and thus prevent pump blocks**

 In a first embodiment of this invention there is provided a method of drain pump motor control that will flush through bundles of fibres before they become large enough to jam the pump. Typically the pump motor will be an ac induction motor which may be of the shaded pole type. Figure 1 shows the plan view of a laundry machine sludge pump, with the impeller 1 having two, backwardly inclined vanes 2, 3, with large clearances, especially to the cutwater 4. Figure 2a shows a perspective view of sludge impeller 1. An alternative vortex impeller 5 (Figure 2b) may be used to reduce pump noise. It has vane recessed into the impeller.

35 The method of operation involves stopping the pump very quickly for a short period of time every few seconds. The sudden stop of the pump means that there is no more energy put into the vortex, and the momentum of the water flowing down the

discharge pipe sucks the vortex and any fibres entrapped in the vortex out the pump exit. The pump is started again before the velocity in the discharge pipe reduces to zero so that the trapped fibres carry on out into the drain. If the pump off time is too long the discharge flow will stop and then reverses returning the fibres to the pump.

5 To achieve the sudden stop, a direct current is applied to the shaded pole (asynchronous) motor for 200mS. This current produces a stationary flux that acts as a brake. It has been found experimentally that a stop for 200mS every 10 seconds gives the best results.

10 In one embodiment of this invention the shaded pole motor has half wave rectified voltage applied to produce the stationary flux. Figure 3 shows the voltage history of this half wave rectified version, with interval 6 the first 200mS stop interval, then a ten second (full wave) pumping period, 7 followed by a second 200mS stop period 8.

Variable Speed Induction Motor Drain Pump

15 The laundry machine drain pump motor 15 of the present invention is driven from four switching devices 11 to 14 in an "H-bridge" configuration as shown in Figure 4 to switch a 230V / 50Hz AC induction motor for the above described drain pump from a 325V DC rail (peak value of 230 volt RMS mains voltage), under the control of a microprocessor (not shown). The switching signals are pulse width modulated
20 with a variable duty cycle. This allows the frequency and RMS voltage being applied to the pump to be controlled.

Variable Speed Pumping during drain

25 When the water level in the laundry machine bowl is above a predetermined height - the "bowl float level" in a machine of the type described in New Zealand patent 215389/217623/218356 - the pump speed is set to 60Hz, to maximise the flow rate. This is achieved by programming the microprocessor which controls the switching frequency of the H bridge switching devices. When water level is below this predetermined height, "ventilation" will occur. The microprocessor is programmed to
30 drive 50Hz at such water levels. This reduction in speed reduces the noise level of the pump considerably, but still allows pumping over an acceptable head height.

The variable speed pumping described has three main advantages over fixed speed pumps:

35 (a) the drain time at 60Hz is approximately 15% less than at 50Hz, due to the higher flow rate to reduce a typical cycle time by about 1-2 minutes,

(b) audible noise is greatly reduced during "ventilation" by slowing the pump to 50Hz, and (c) the same 230VAC / 50Hz pump design can be used irrespective of country in which the laundry machine is used.

5 *Low frequency, high torque pump startup*

To overcome the problem of the starting torque of AC induction motors being increases when the supply frequency is decreased in the present invention, when the pump starts, the drain pump microprocessor switches the H bridge devices 11 to 14 to produce a 30Hz drive current to the pump motor but with an increased PWM duty cycle, for the first four revolutions (ie. 80ms at 50Hz). This provides a high torque "kick", which will attempt to dislodge anything which is impeding the pump impeller.

10 The microprocessor subsequently controls the H bridge devices to produce a drive current at the target frequency (50 or 60Hz), but with a high PWM duty cycle, for the next 150 revolutions (3 seconds at 50Hz). This helps to initially get the water over the required head height.

15 After these two "startup" phases, the microprocessor causes the PWM duty cycle to revert to the "normal" duty cycle for the desired drive frequency.

By programming the microprocessor to control the frequency and duty cycle during pump startup in this manner a reduction in pump blockage can be achieved.

20 *Variable pump PWM depending on mains voltage*

The nominal AC mains RMS voltage has a typical tolerance of 10%, which for nominal 230V AC, equates to a range of 207 to 253 volts. In rural areas, this variation can be even greater. This mains voltage variation has an effect on the current supply to the drain pump and thus the torque of the drain pump. The maximum head height and flow rate of the pump can therefore vary depending on the location of the laundry machine.

25 In this invention, the microprocessor is also caused to measure the DC rail voltage, and from this determine the mains voltage. The microprocessor is programmed to compensate for differing mains voltages by adjusting the duty cycle of the drive signal supplied to the pump motor. If the AC mains voltage is reduced, the duty cycle is increased, and vice versa, thereby ensuring a constant torque in the drain pump over a wide range of mains conditions.

30 When driving the pump at 60Hz, the maximum torque available is less than when driving at 50Hz. If the pump is operating at 60Hz, and the mains voltage drops below a predetermined level (200V for nominal 230V), the flow rate will drop to an

35

unacceptable level. In the present invention the microprocessor is programmed to reduce the frequency of the pump drive current to 50Hz, and 60Hz operation disabled until the microprocessor is reset.

By using variable duty cycle that is caused to vary as a function of mains voltage, a constant drain pump performance is maintained over a wider range of actual mains voltages than is normally possible. Secondly, by disabling the 60Hz mode of operation when the mains drops below a predetermined voltage, the problem of very low flow rates is avoided when attempting to drain at 60Hz under low mains conditions.

Pump Over-current Detection

Washing machine drain pumps are susceptible to water damage if they leak. This water damage eventually causes electrical shorting of the pump windings increasing the winding current and causing the pump it to overheat and fail, due to the change in winding resistance and inductance characteristics. As well as being a potential fire/smoke risk, this overheating and failure can also damage the hardware that is driving the pump, unless additional protection is provided.

Conventionally, there is no feedback indicative of current in the pump windings, so there is no "early warning" that the pump is being damaged in such circumstances. In the present invention the current peaks in the pump windings are monitored by the microprocessor. The current may typically peak at approximately 1.1A (rms = 650mA). If the microprocessor detects two consecutive current peaks of greater than 2.6A, it is programmed to flag a "pump overcurrent" fault to the pump motor controller microprocessor.

Since the change in electrical characteristics from water damage is gradual, this fault condition will occur and be detected before any other parts of the circuit are damaged, and before the pump becomes a potential fire/smoke hazard. It allows the replacement of a water-damaged pump before any other subsequent damage occurs.

Power Supply ON-OFF

In a third embodiment the invention provides a means of allowing a laundry machine power supply to power down automatically and power up via a low voltage, low current switch. This eliminates the need for a high current and/or voltage rated switch and ensures negligible power consumption when the laundry machine is not in use.

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Referring to Figure 4 power supply for the machine is produced by employing a simple switch mode power supply (SMPS) topology that is controlled by a microprocessor 17 and makes use of the main motor windings 15 and motor drive circuit 11 to 14. This general form of laundry machine power supply is described in the applicant's Australian Patent 651408. The power supply is disabled by a hardware circuit (fourth wire circuit). Power down functions are initiated by the micro processor and locked by the fourth wire circuit. Power up functions are initiated by the user via a low voltage, low current push button SW1.

Power down

When the machine has finished a task and has received no further instructions for some defined time period, the microprocessor simply reduces the power output of the SMPS to zero hence powering down the machine. The fourth wire circuit is then enabled to ensure the SMPS does not power up until the user presses the appropriate push button on the control panel. This dramatically reduces the power consumption of the machine compared to that required by hardware lockout circuitry.

Power up

The user presses a power button which disables the fourth wire circuit that is disabling the SMPS. The SMPS then starts up and brings alive the microprocessors. The machine is now ready for use.

In Figure 4 a buck converter is inherent in the H-bridge topology of the motor drive. Assuming that A+ and B- devices 11 and 14 are off when the circuit is run as a buck converter, then the A- device 12 is latched on and B+ device 13 is driven by a PWM signal to control power output. The circuit can be modified by adding the "hardware lock off" circuitry to provide shutdown and start up functions.

Power down

To shut down the SMPS the microprocessor simply turns off the A- device 12 by turning on transistor Tx2. The nominal 15v rail 16 (produced by the SMPS) will drop in voltage and transistor Tx1 previously biased on by the 15v, will turn off allowing capacitor C1 to charge from the high voltage DC rail 18. C1 then latches transistor Tx2 on hard so that the A- device 12 is latched off. Thus the buck converter is disabled.

Power Up

The user presses Sw1 which short circuits and discharges capacitor C1 thus turning off transistor Tx2 allowing the A- device 12 to turn on. The SMPS is then able to start up and produce the 15v rail 16 required to latch transistor Tx1 on. The machine is now ready for use.

The employment of the described microprocessor controlled SMPS has the following advantages:

(a) a cheap low current, low voltage switch to be used to provide power up functions, (b) the power switch can be referenced to the SMPS zero volt rail allowing it to be used for other functions, (c) allowing the SMPS to shut down extends the life time of components and reduces any emissions from the product (i.e. RFI, EMI), (d) provides very low power consumption when not in use, and (e) eliminates transients caused by mains power interruption.

ECM Motor Drive

In a fourth embodiment the present invention provides a low cost high side drive for an H bridge switching circuit for an electronically commutated motor. Such a switching circuit is shown in Figure 5 for commutating a three winding motor.

The present invention provides a more cost effective circuit to that shown in Figure 6. This is shown in Figure 7. Here, turn off of Q2 tends to turn on Q1. The value of resistor R is selected to limit the turn on speed of Q1 so there is no risk of overlap. Because this causes a slewed turn on for Q1, this circuit is only appropriate for switching Q1 at low frequency. Therefore the motor must be energised at audible switching frequencies.

The optocoupler can have relatively low gain and slew rate, which allows the use of a more cost effective device. There is also no need for an inverter such as q4 in Figure 6.

Configuring at least one high side drive as in Figure 7 is necessary to facilitate the power supply ON-OFF concept described in relation to Figure 4.

Braking the Wash Tub Motor

In a fifth embodiment the invention provides a low cost method of braking a laundry machine motor.

One of the functions of a top loading vertical axis washing machine is to spin the wash tub at high rpm to remove excess water from the clothes at the end of the wash cycle. A spinning tub is unsafe for a user to touch so many machines have a

brake function that quickly stops the spinning tub if the access lid is opened. This brake function can be done by different techniques and one technique that is becoming more common is to use regenerative braking from the main drive motor. Using this technique the drive motor effectively acts as a generator during brake and converts the energy from the spinning tub into electrical energy which is typically then converted into heat and dissipated via a dump resistor.

The present invention connects a motor or solenoid installed in the machine for some other purpose across the DC voltage rails for the motor so that the electrical energy generated during braking of the spinning tub can be dissipated in this motor/solenoid impedance saving the cost of additional components needed for a dump resistor or equivalent. The power dissipation component chosen must not be in operation for its primary purpose during braking of the spin tub.

The circuit shown in Figure 8 has a 3 phase brushless DC main motor 21 for driving a laundry machine agitator (not shown) and or spin tub and a water pump powered by an AC induction motor 22 both driven from the HVDC bus. The three winding motor 21 is driven from the six transistor bridge 29 to 34. The pump motor 22 is driven from a four transistor H bridge 23 to 26 which in turn is switched by current steering circuitry 27 under the control of microprocessor 28. When main motor 21 is driven by the angular momentum of the spin tub as a generator, during a brake phase when switching devices 29 to 34 are off, electrical energy is fed back into the HVDC bus through free wheeling diodes 35 to 40 which results in an increase in the bus voltage. The bus voltage is sensed by microprocessor 28. When the bus voltage exceeds 400V DC, the microprocessor through current steering circuitry 27 switches transistors 23 and 26 of the pump H bridge hard on until the bus voltage falls below 390V. In this way the regenerative braking energy is dissipated as heat in the pump motor windings. This heat is dissipated in the pump as power according to the equation:

$$P_{\text{pump}} = I_{\text{pump}}^2 \times R_{\text{pump}} \dots \dots \dots (1)$$

For a pump of this type the motor windings typically have a resistance of approximately 34 ohms. Therefore for a braking power of say 600W, from equation 1, the pump winding current is around 4.2 amps during braking.

The following advantages are achieved by this embodiment of the present invention: (a) a dump resistor and control circuit are eliminated, (b) by turning the pump on after a braking phase the braking energy (heat) can be quickly dissipated by the pump fan, (c) the heat rise due to the energy (heat) being dissipated in the pump

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windings is remote to the usually enclosed main motor electronics area where it can be difficult to ventilate and hence cool, and (d) the motor winding inductance reduces the peak currents that would flow in a purely resistive load, and hence the switching transistors.

5 It should be appreciated that other existing laundry machine resistive/inductive components could be utilised in place of the drain pump motor as a means of dissipating power. For example the solenoid in a solenoid controlled valve or other actuator could be used.

CLAIMS:

- 5 1. A method of operating a drain pump in a laundry washing machine during the drain phase of the wash cycle to reduce pump blockages comprising the steps of: (a) starting the pump and running it for a first period of time, (b) stopping the pump for a second period of time which is less than 10% of said first period of time, and repeating steps (a) and (b) for the duration of said drain phase.
- 10 2. A method of operating a drain pump in a laundry washing machine during the drain phase of the wash cycle to reduce pump blockages characterised in that:
 - (a) the pump is started and run for a first period of time,
 - (b) the pump is stopped for a second period of time which is less than 10% of said first period of time, and
 - 15 (c) steps (a) and (b) are repeated for the duration of said drain phase.
3. A method according to either of claims 1 or 2 wherein said second period of time is between 10% and 1% of said first period of time.
- 20 4. A method according to any one of the preceding claims wherein the first period of time is approximately 10 seconds and the second period of time is approximately 200 milliseconds.
- 25 5. A method according to any one of the preceding claims wherein said pump is driven by an AC induction motor, during said first period of time said motor is supplied with full wave alternating current and during said second period of time is supplied with half wave alternating current.
- 30 6. A laundry washing machine including a drain pump operated in accordance with the method of any one of claims 1 to 5.
- 35 7. A method of braking a top loading laundry washing machine spin tub wherein said spin tub is driven by an electronically commutated DC motor, wherein the commutation devices are connected to a DC power supply and have free-wheeling diodes connected in parallel therewith, and wherein said washing machine includes other components having inductive windings,

characterised in that:

commutation of power to the motor windings is terminated,

the voltage of the DC power supply is monitored,

and when the DC power supply voltage exceeds a pre-determined value the
inductive winding of an unused component in said machine is connected across said
DC power supply until the DC power supply voltage reduces below said pre-
determined value.

8. A method according to claim 7 wherein said unused component is a water pump
powered by a single phase induction motor, the winding of which is electronically
commutated from said DC power supply by bridge connected switching devices, said
switching devices are controlled by a microprocessor, the DC power supply voltage is
monitored by said microprocessor and said microprocessor causes said switching
devices to connect the winding of said pump motor across said DC power supply.

9. A top loading laundry washing machine having a spin tub which is braked
according to the method of either one of claims 7 or 8.

10. A method of powering on and off a laundry washing machine where power is
consumed in the form of direct current using a switched mode power supply of the type
described in Australian Patent 651408 characterised in that:

an active switching device connected between the base of the lower switch in
the motor bridge drive used as part of said switched mode power supply and the lower
voltage rail is switched on by a latching circuit to cause the DC power supplies in said
machine to be disabled,

the latching circuit comprises a capacitor charged from the high voltage rail for
said laundry machine motor in parallel with a transistor biased from the switched mode
power supply low voltage rail, and

a push button normally off switch connected in parallel with said capacitor is
used to discharge said capacitor to disable said latching circuit to thereby enable the
laundry machine DC power supplies.

11. An optocoupler drive circuit for the high side of a totem pole power transistor
pair in a bridge circuit for commutating a motor characterised in that the optocoupler
does not use a logic inverter on the output side and the optocoupler transistor is

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controlled to limit the speed of turn off and thus the speed of turn on of the upper power transistor in the totem pole.

5 12. A laundry washing machine including a wash bowl drain pump characterised in that:

said pump is driven by a variable speed motor which in turn is driven by a variable frequency pulse width modulated inverter,

and the pump motor frequency is decreased at low bowl water levels to reduce the effects of ventilation.

10 13. A laundry machine according to claim 12 wherein the inverter pulse width modulated duty cycle is increased on pump start up and reduced upon normal pump frequency being achieved.

15 14. A laundry machine according to either of claims 12 or 13 wherein the inverter duty cycle is varied as an inverse function of the mains voltage supplying the machine to ensure constant motor torque independent of mains voltage.

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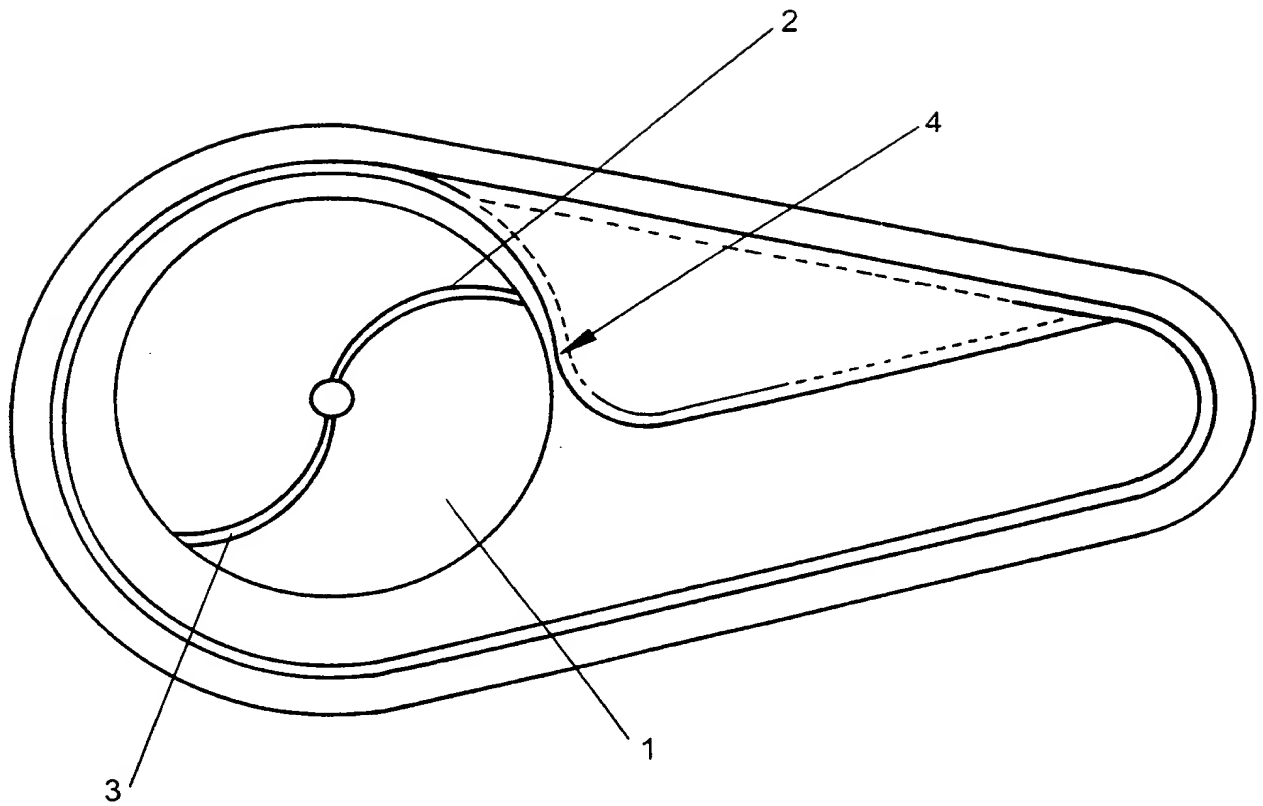


FIG. 1

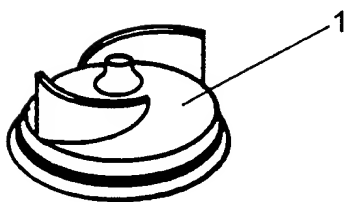


FIG. 2A

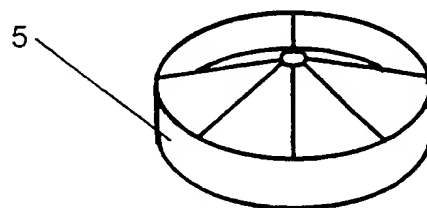


FIG. 2B

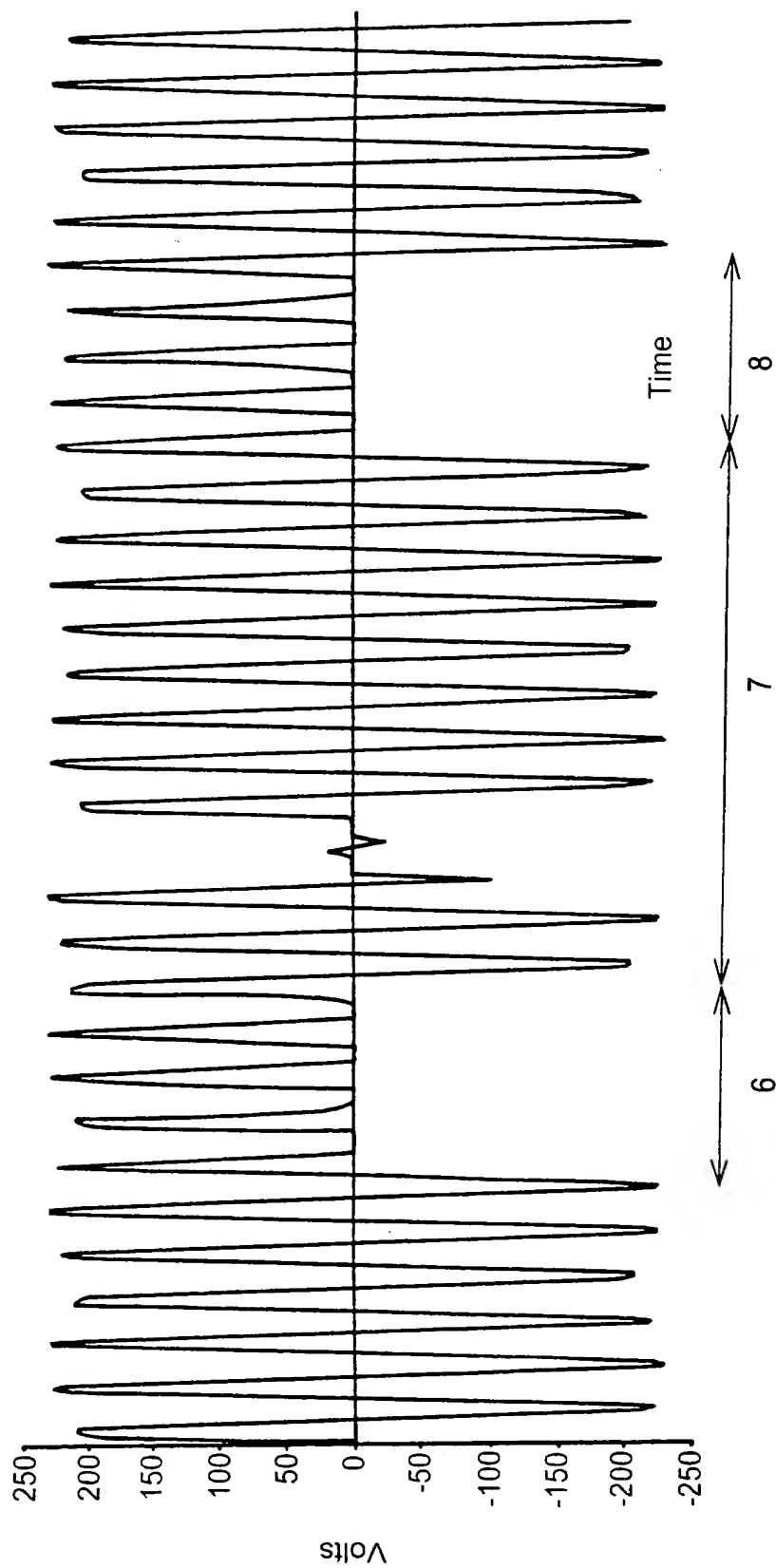


FIG. 3

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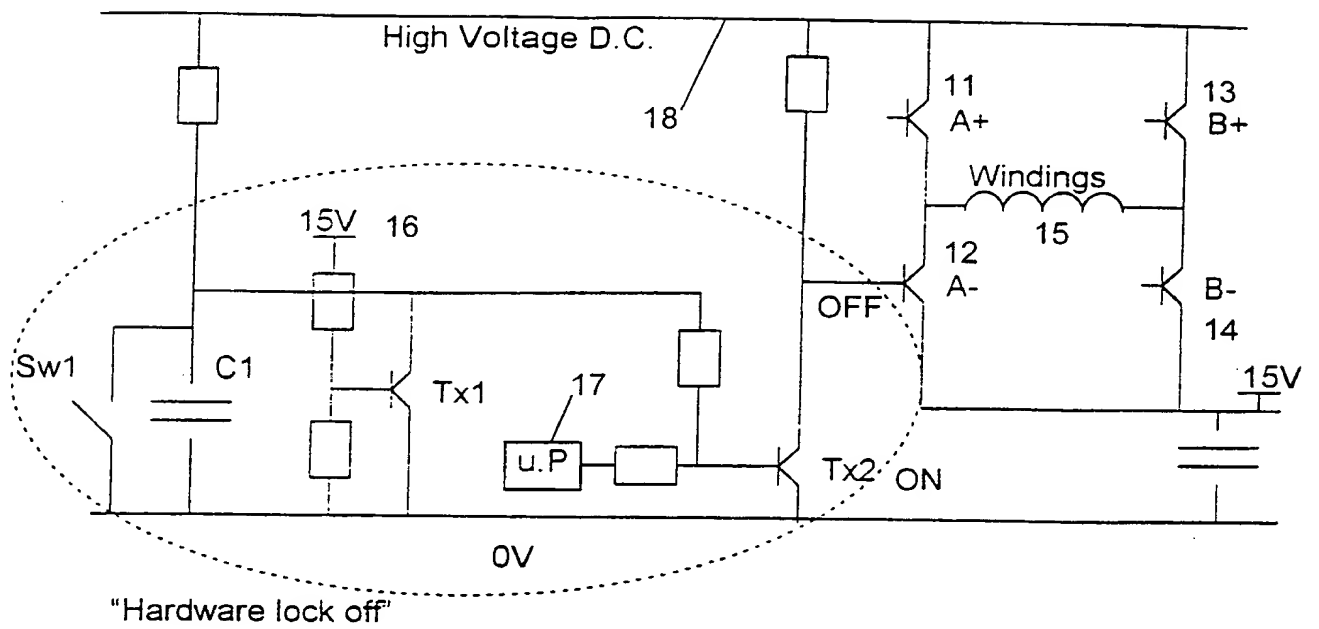


FIG. 4

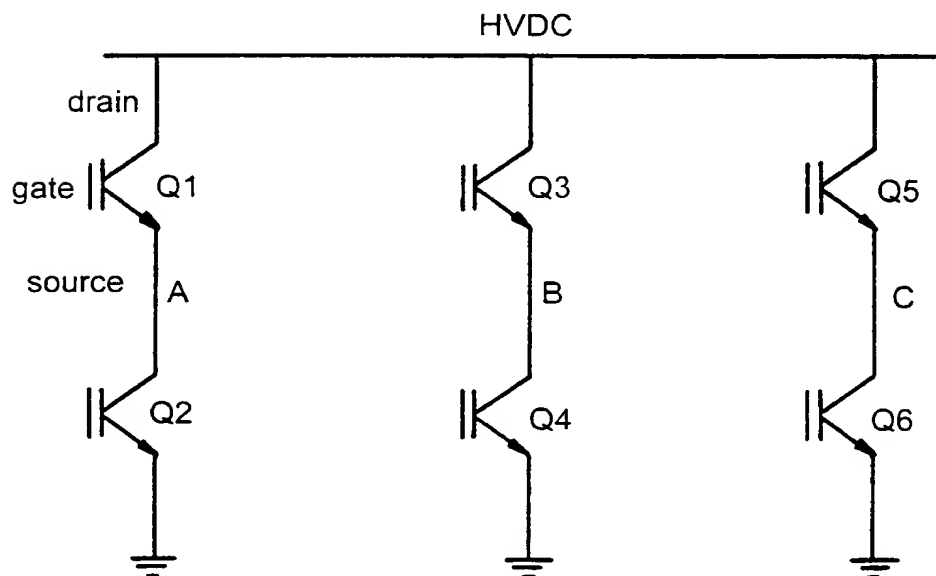
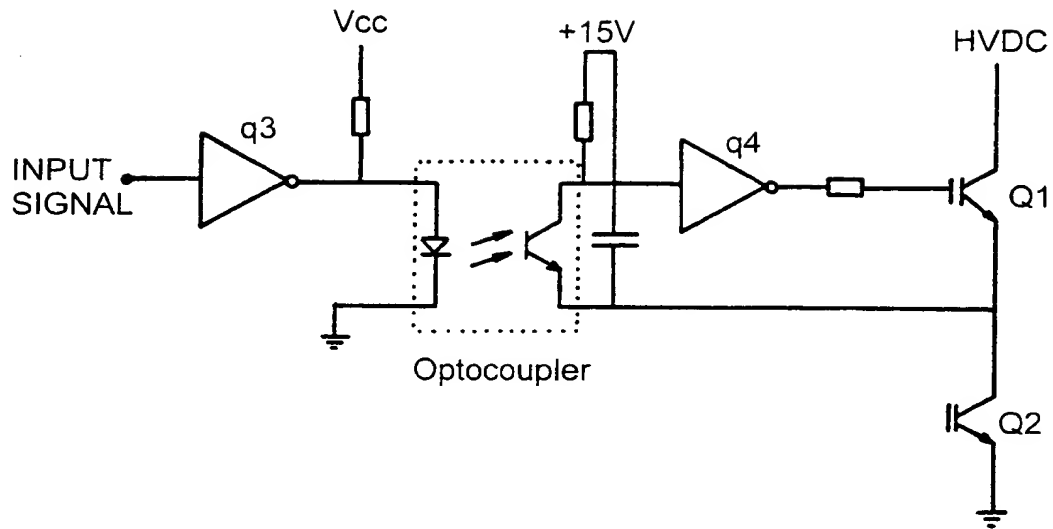
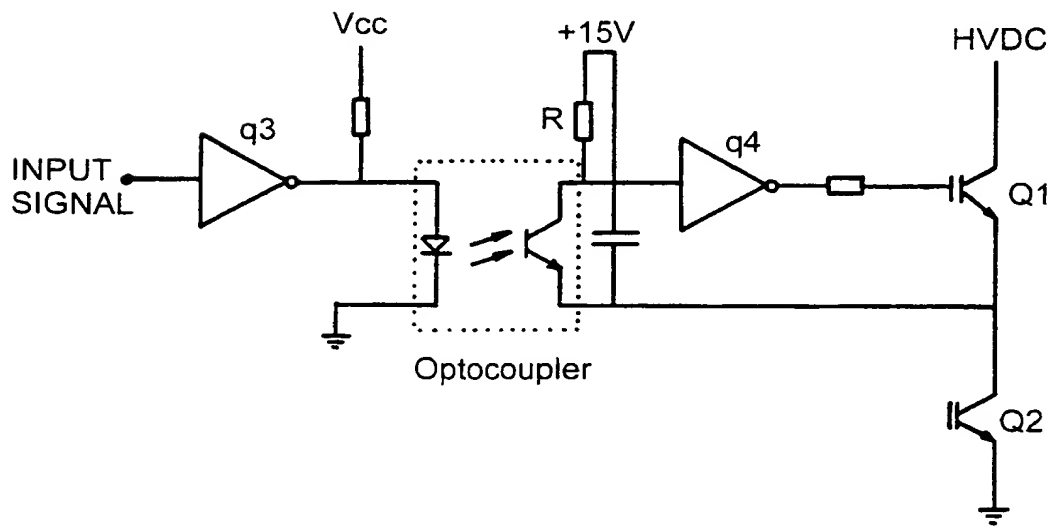
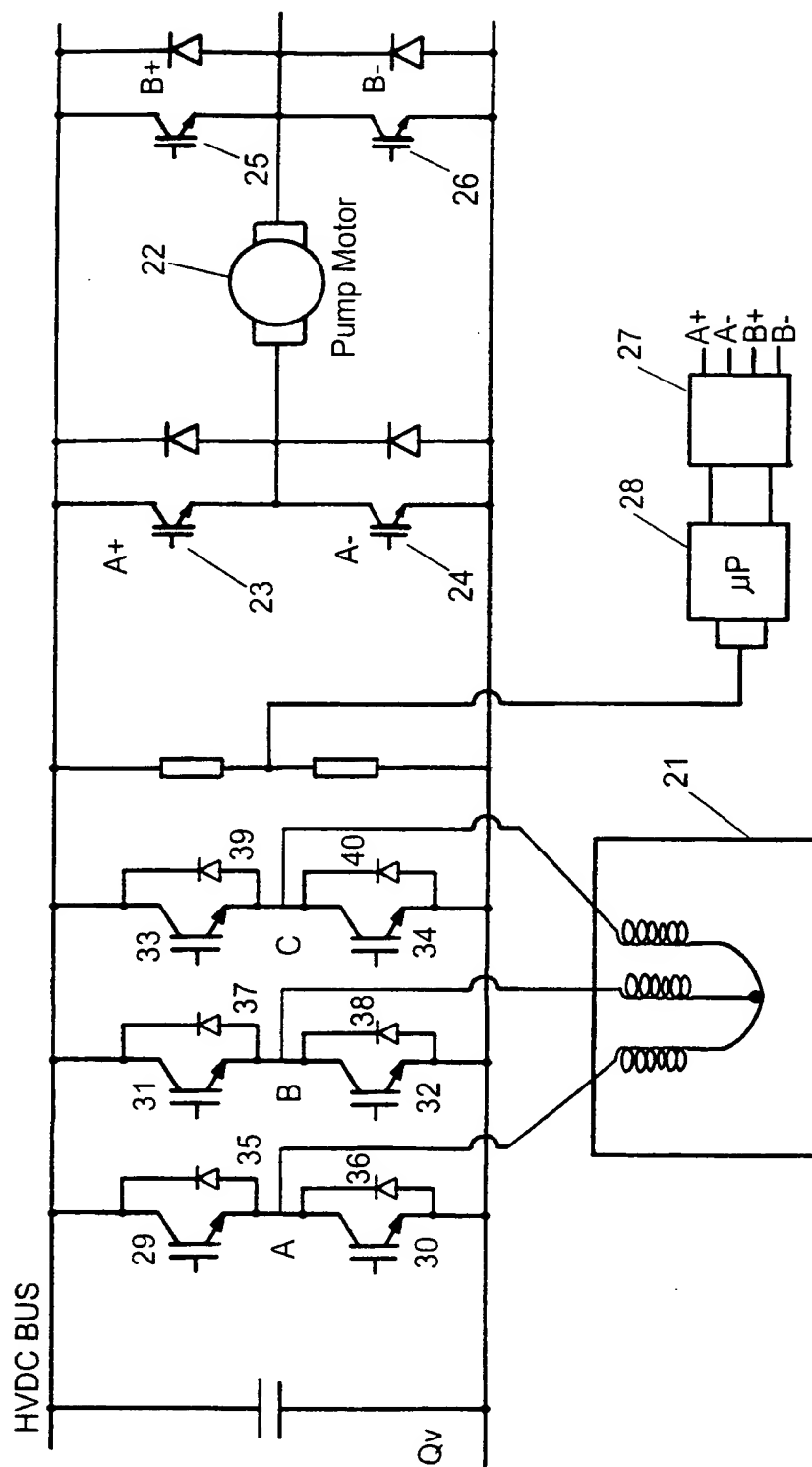


FIG. 5

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**FIG. 6****FIG. 7**

**FIG. 8**

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ 99/00193

A. CLASSIFICATION OF SUBJECT MATTER																						
Int Cl ⁷ : D06F 33/02																						
According to International Patent Classification (IPC) or to both national classification and IPC																						
B. FIELDS SEARCHED																						
Minimum documentation searched (classification system followed by classification symbols) D06F 33/																						
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched																						
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT : D06F 33/- and pump + and (stop+ or repeat+ or or intermit+)																						
C. DOCUMENTS CONSIDERED TO BE RELEVANT																						
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																				
X	Derwent abstract Accession No 86-234682/36 class F07 JP 61162980 A (MATSUSHITA ELEC IND KK) 23 July 1986 Abstract	1-6																				
X	Derwent abstract Accession No 93-139666/17 class F07 JP 05076687 A (HITACHI LTD) 30 March 1993 Abstract	1-6																				
X	Derwent abstract Accession No 98-265302/24 class F07 JP 10085487 A (SANYO ELECTRIC CO LTD) 7 April 1998 Abstract	1-6																				
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex																						
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A"</td> <td>Document defining the general state of the art which is not considered to be of particular relevance</td> <td>"T"</td> <td>later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"E"</td> <td>earlier application or patent but published on or after the international filing date</td> <td>"X"</td> <td>document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"L"</td> <td>document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"Y"</td> <td>document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"O"</td> <td>document referring to an oral disclosure, use, exhibition or other means</td> <td>"&"</td> <td>document member of the same patent family</td> </tr> <tr> <td>"P"</td> <td>document published prior to the international filing date but later than the priority date claimed</td> <td></td> <td></td> </tr> </table>			"A"	Document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family	"P"	document published prior to the international filing date but later than the priority date claimed		
"A"	Document defining the general state of the art which is not considered to be of particular relevance	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention																			
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"P"	document published prior to the international filing date but later than the priority date claimed																					
Date of the actual completion of the international search 10 March 2000		Date of mailing of the international search report 20 MAR 2000																				
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No.: (02) 6285 3929		Authorized officer PETER WARD Telephone No.: (02) 6283 2129																				

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ 99/00193

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 407272 A (ESSWEIN S.A.) 9 January 1991 Abstract	1-6

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/NZ 99/00193

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-6, a method of operating a drain pump in a washing machine.
2. Claims 7-10, a method of braking a washing machine spin tub.
3. Claim 10 directed to a method of powering on and off a washing machine.
4. Claim 11 directed to an optocoupler drive circuit.
5. Claims 12-14 directed to a laundry machine drain pump drive.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-6

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

International application No.
PCT/NZ 99/00193

Patent Document Cited in Search Report

Patent Family Member

EP	407272	FR	2649422
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